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Generation Z Food Waste, Diet and Consumption Habits: A Finnish Social Design Study with Future Consumers

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Abstract: This article presents a Finnish social design study that was targeted at future Generation Z consumers. The main objective was to gain understanding of the target group's attitudes, routines and skills relating to food consumption, diets and food waste within their households. The sustainability framework studied the Generation Z experience, obstacles and opportunities relating to behavior patterns, in addition with current habits—with respect to planning, shopping, cooking, eating and storing—and future motivations. The aim of the social design investigations was to provide contributions to the design outcome: a behavior change application that steered young consumers' behavior patterns towards a more sustainable direction. The design framework was applied in two case studies that focused on 17–26-year-old consumers in Finland. The main method was qualitative online focus group discussions. Based on the results, the most important behavior change opportunities related to social aspects, the role of company sponsoring, localization and context-awareness potential in young consumers' close environment and the need to engage wider sustainability aspects—such as carbon footprint, comparison of diets and financial savings—to the behavior change framework. Based on the results, the participants took the climate change challenge associated with food waste and biased diets very seriously.

Keywords: food waste; waste prevention; food waste behavior and habits; future consumer; generation Z; social design; design interventions; focus group discussions; sustainability

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1. Introduction

The global food system makes a significant contribution to climate changing greenhouse gas emissions, biodiversity loss, water extraction and pollution with all stages in the supply chain, from agricultural production through processing, distribution, retailing, home food preparation and waste, all playing a part [1]. It has been estimated that nearly one-third of the total food mass and about one-quarter of the total food calories produced globally are lost or wasted [2,3]. The most food waste is generated by households and consumers [4], and, therefore, consumer food waste is a major concern. In Finland around 130 million kg of food waste are generated each year (23 kg per capita/year) by the household sector [5]. Most of the discarded food is fresh and perishable, or leftovers from cooking and dining (ibid.). Yet, the problem is more complex, as wasting food is not a single behavior but the result of a multitude of different behaviors occurring at various points of interaction between the consumer and the food [6].

The focus of this research was on future consumers and their habits relating to food consumption and food wasting habits. In general, future consumers and their consumption behavior can be associated with large-scale global concerns relating to sustainability, intertemporal consumer choices and life cycle models. Since future consumers are in the center of social acceptance, it is important to also study their attitudes from the business perspective, in order to create sustainable and durable choices while answering to the needs of the consumers [7]. The most relevant future consumer group for this study was

chosen to be Generation Z (Gen Z)—covering birth years of mid-to-late 1990s and the early 2010s. These young consumers are important as they have the potential to frame their food consumption patterns in relation to climate concerns, as according to Stanes et al., most changes, such as those that are physical, developmental and social occur in this particular age [8]. Fischer et al. state, that as 17–25-year-olds are usually moving out from their parents' home, this increases the responsibility of the young person itself, and develops opportunities for sustainable consumption habits [9]. Gen Z also seemed noteworthy since the generation had been raised during the technology boom of the millennium and so were comfortable with and reliant on technology for most aspects of their lives. They can thus be seen as early adopters of new technology-mediated waste food application solutions.

In regards to food, Kamenidou et al. (2019) has perceived that Gen Z does not usually engage with sustainable food consumption beyond attempting to eat locally and seasonally [10]. However, they expect more from companies in terms of sustainability and place a high importance on reducing single use plastics, engaging with fair trade and recycling schemes [11]. Gen Z may lack the cooking skills to overcome food waste issues at home but are highly interested in learning more; something they are likely to rely heavily on technology and social media for. So far, the sustainable food consumption research regarding Gen Z has focused on sustainability solely from the point of consumption [10–13] rather than food waste habits and waste reduction behavior. A research gap can be identified more explicitly when examining the habits, obstacles and opportunities for Gen Z in relation to food waste. Therefore, this study examined what were the target group's attitudes, routines and skills relating to food consumption, diets and food waste within their households.

Social design [14] and socially responsive design [15] have recently flourished as promising methodologies to address the inefficiency of existing models and policies targeting the most pressing global concerns. Social design emphasizes the process of solving social problems with ecological technology design, with carefully predefined community samples, and with the aim of social ecology transformation [16–18]. In social research, like in any qualitative research, it is common to build an investigational phase in order to develop a better understanding of the broader context together with ecology participants. For the methodology, semi-structured Focus Group Discussion (FGD) was selected in order to build upon the existing knowledge, but also to allow new, pertinent information to arise [19,20]. As for the content—Gen Z habits in relation to food waste—the methodology followed roughly the steps of the COM-B model (capability, opportunity, motivation-behavior): a framework for characterizing and designing behavior change interventions and for eliciting habits [21,22]. In addition, the research builds on the Theory of Planned Behavior (TPB) and was used explicitly for exploring food waste habits [23,24]. It should be noted that existing studies on TPB focus on general populations; not on specific generations and how their social characteristics may affect food waste behavior and habits. The research framework was divided in three parts: (1) Experience, (2) Obstacles and Opportunities, and (3) Habits and Future Consumer Motivations. The "Experience" part of research was formulated under the question: "What are the Gen Z routines and experiences related to food consumption, food waste and sustainability aspects". The "Obstacles and Opportunities" for sustainable food consumption was formulated under the research question: "What are the incentives and barriers that would change Gen Z food consumption behavior into more sustainable one". The "Habits and Future Consumer Motivations" part was formulated under the research question: "What are the current habits and socio-technical aspects that would change Gen Z food consumption behavior into a more sustainable one".

Accordingly, this design research imposes itself on the field of social design regarding the sustainability concern associated with food waste. The ecology sample was Gen Z in Finland and the short-term objective was to assess the target group's attitudes, routines and skills in relation to food consumption and food waste habits. The material of the social design investigations was exploited in a follow-up research study that built a technical

behavior change application (Cook Clever) with a Habit library for supporting sustainable food consumption behavior. The socio-technical aim of the design outcome was to steer future consumers' consumption patterns towards more sustainable behavior by reducing food waste within their households.

2. Materials and Methods

The main objective was to gain an understanding of the target group's attitudes, routines and skills relating to food consumption, diets and food waste with the qualitative social research approach [25]. Geels (2011) has proposed creating a practical sustainability framework within the social research context, in order to sketch the most important dimensions of the related issue, and help to specify the types of questions that should be asked from the participants in the transition area [26]. In this context, the sustainability framework was developed for investigating the food waste generation and consumption patterns of Generation Z in the transition area when they moved from their parents' home and started to build independent lifestyles and consumption habits [8,9]. The sustainability framework was explicitly built upon the experiences, obstacles and opportunities relating to Gen Z behavior patterns, in addition to the habits relating to planning, shopping, cooking, eating and storing and future motivations.

The main research method was qualitative Focus Group Discussion (FGD), which essentially offers researchers the opportunity to interview several respondents systematically and simultaneously and promote discussion among the participants [25]. In FGD the onus is not on generalizable findings, but purposeful use of social interaction in generating data [19,25]. The benefit of FGD is that discussions can spark off one another, suggesting different dimensions and nuances of the original problem that any one participant might not have thought of. In order to tackle most common problems addressed with FGD as method, the focus groups in this study were as homogenous as possible with similar demographics, as suggested by Acocella [27]. The intention of this was to ensure that the conversation remained on a level where it was easy for each participant to be engaged with the discussion and point out their personal opinions and experiences. Due to the rapid improvement of the internet facilities, the use of online focus groups has been a growing trend in research over the past decade [20]. Fox et al., (2007) note that the online FGD are particularly suitable within the younger populations, as they are familiar and comfortable with the online communication technologies [28]. Online FGD can be divided into two categories: asynchronous (with no timing requirement) and synchronous (occurring exactly at the same time period) [20]; of which both were used in this social design framework. The asynchronous online discussions were held with case study group A, and the synchronous discussions with case study group B (see Table 1).

Table 1. Characteristics of the sample (Focus Groups A–B) and application interview (Group C).

User Groups	Held, 2020	Age av. (Years)	Male	Female
Group A	April	22.4	4	22
Group B	May	19.2	9	15
Group C	Sept–Oct	22.2	3	6

The reason to conduct two case studies was, at first, to focus on food consumption and food waste habits in general, and then move forward with in-depth questions of sustainable food consumption. In addition, the online tool used for group A allowed some quantitative fact polls to be incorporated. However, due to the small number of participants the quantitative part of research and its results cannot be generalized. As the objective was to study the transition area when Generation Z participants were moving from their parents' home and established independent lifestyles and practices, the results from both groups were combined and used for the creation of a mobile application (Cook Clever). In essence, the application was built upon a Habit library that aimed at supporting behavior change towards creating less food waste. Group A participants were closer to the end of

the Gen Z age scale, identified as post-Millennials. They were aged 18–26 (with the average age of 22.4 years); four were (4) male and twenty-two (22) female. Altogether there were 26 participants. The place of residence was mostly Helsinki or the area of Uusimaa and Tampere (Finland), and they were upper secondary school students, or undergraduate and graduate students from the University of Tampere and University of Helsinki. Twenty-one (21) were full time students, of which four (4) had part-time employment; three (3) were full time employed; one (1) a part time student and one (1) with no employment. There were several experts in the discussion group as their university major was in environmental and food sciences, forestry, agronomy or related fields; or their occupational title was cafeteria employee or hospitality manager. The participants of the group B presented younger population sample, as they were aged 16–25 (with the average age of 19.2 years); nine (9) male and fifteen (15) female. Altogether there were 24 participants (see Table 1). Their place of residence was mostly Espoo and Helsinki, with individual participants from all over Finland; seventeen (17) of the participants were upper secondary school students and seven (7) undergraduate and graduate students. In both groups, the participants' place of residence was mostly located in the city center, or close to the city center and densely populated communities in the urban area.

The asynchronous online discussions were organized by exploiting the Howspace-platform (provided by a Finnish company Humap Software). The two-week online discussion period was held in April 2020. Questionnaires, containing only personal and private data, and open conversations, including both quantitative (fact polls) and qualitative aspects, were considered the most appropriate set of methods (see Supplementary S1. Questionnaire for the asynchronous Focus Group A). The questionnaire collected information about the characteristics of the Generation Z, and the open conversation, available to all, was targeted at more general discussions. The synchronous discussions with group B, held in May 2020, included more in-depth questions (see Supplementary S1. Questionnaire for the synchronous Focus Group B). The case study with group B contained altogether eight sessions (each having 2–4 participants) that were conducted by using an online video platform, Microsoft Teams.

This article also includes some initial results of the behavior change application (Cook Clever) development study, for which the habit information of Gen Z (groups A and B combined) was mainly used. The iterative design of the application was conducted by think-aloud evaluations that were conducted during September and October 2020, in order to collect the first impressions. There were nine participants, aged 18–25 (with the average age of 22.2 years), in the application interview group C; three were (3) male and six (6) female. Most of them had participated also in the discussion conducted with group A. The evaluations were carried out as team meetings with one participant and two researchers present in the interview.

All participants were enrolled from a register of students, from, altogether, five high schools and universities in Finland. The participants expressed interest in taking part in the experiment or they were solicited via a teacher or a society called the Martha organization (providing advice in home economics). All subjects gave their informed consent for inclusion before they participated in the study. It should be noted, that due to the specificity of the group selection and its size, the research results are generalized knowledge of the entire population Z. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of VTT (approved on 16 April 2020).

3. Results

In the case study targeted at future Gen Z consumers, the main objective was to gain understanding of the target group's attitudes, routines and skills relating to food consumption and food waste within households, in addition to their experience in diet-related issues and incentives to steer their consumption patterns towards more sustainable behavior by reducing food waste.

3.1. Experience

The "Experience" part of research was formulated under the question: "What are the Gen Z routines and experiences related to food consumption, food waste and sustainability aspects". In this part, the participants were requested to inform about their life with food consumption and open up about their food waste experiences. The questionnaire was aimed at defining the factual data and provisional characteristics of the future consumers.

In group A, the current living situation of most participants was living alone or with a partner or spouse. In the younger group B, the most common living status was with parents and siblings. Group A participants were asked in more detail about their experience in using technologies. They stated to be keen for trying out new mobile applications, and three of the most important social media services were: Instagram (24 responses); Facebook (19 responses) and WhatsApp (11 responses). The participants were also quite familiar with applications and websites relating to food waste. Seventeen (17) had used Restaurant Food Rescue services (which in Finland are e.g., ResQ Club and Lunchie Market) and twelve (12) had used an online store for loss and depreciation food items (which in Finland are e.g., MatSmart and Fiksuruoka). Group A participants were also knowledgeable about the websites or applications that shared information about food waste: ten (10) were familiar with such Finnish websites such as Ruokatieto, Hävikkimestari and Martha home economics.

The participants stated that the most purchased food items in their personal households were fresh products such as fruits and vegetables, bread and different protein sources. Furthermore, dairy products were common, whereas some replaced those with plant-based options, such as oat or soy products. The dietary choices varied from omnivorous to vegetarian to vegan and flexitarian (whose diet is mainly plant-based but contains occasionally meat). A few participants were enthusiastic about non-processed and locally produced food; on the other hand, only a few stated that they bought ready-made meals or convenience food. For the amount of food thrown away in personal households, the participants responded "hardly any" or "less than 10%"; at maximum "between 10% and 25%"; with none stating that the food waste was "above 25%". The participants explained that food waste in their households was composed mostly of fresh products: the majority responded specifically to the question "What is thrown away in your household" with "fresh fruit, vegetables and berries", and only a few with "bread and other bakery products" or "ready-made meals". Table 2 presents the results of the fact poll about dining away from home or consuming takeaway foods; data that were collected only from group A. As many of the participants were students, dining away from home included also school/university lunch restaurants.

Table 2. Dining away from home or consuming takeaway foods.

Frequency	How Often Do You Dine Away from Home?	How Often Do You Purchase Takeaway Foods?
More than twice a week	7	0
Weekly	3	2
Fortnightly	4	2
Monthly	3	6
Rarely	5	5
Never	0	7

N = 12.

The in-depth discussions aimed to find out what ecologically sustainable food consumption meant for the young consumers in practice. At the core of the "experience" part was asking the participants to explain what "food waste" is and how it affected their personal consumption behavior. The topic seemed to be well-known among the young participants, as they were aware that households and consumers are the main contributors to food waste. In the most simplistic way, food waste was understood as, "food, which

was once edible, but for some reason ends up being thrown away", or, "food, which was thrown in the waste after a meal at home or in a restaurant". On the other hand, some emphasized, that food waste is "food, which is wasted in every part of the food chain with both households and companies in the food industry contributing to its creation."

With group A the most important aspects when making choices about food were stated to be cost, health and convenience. Since environmental sustainability and social sustainability were not considered important in the initial questionnaire, the topic was addressed more closely in the open conversations. With regard to environmental sustainability, most participants stated that they were reasonably aware of the environmental burden of food waste, but criticized that there was not enough information available or, at least, no means to access the actual, relevant data. Many participants specified that there was an evident need for transparency in how companies communicated about the environmental effects of their products. A participant expressed: "It is possible to know exactly how much sugar and protein the food product contains, but I still don't know precisely how much energy the product has consumed, or how much carbon dioxide it has produced." In the open chat the participants agreed that currently the best and only way to communicate was through packaging and company websites. Regarding social sustainability, the participants highlighted that it was "culturally constructed and manifested itself usually through people's personal values". In practice, this was demonstrated in social media as opinions relating to social acceptance of diets and health-related dietary choices. A participant formulated this, as: "Earlier vegetarians had to justify their eating habits, and listen to how important it is to eat meat. Nowadays, in some circumstances, the situation might be the opposite, but evidently meat has still a dominant role in Western diets."

Group B highlighted the impact of meat and other animal-based food products on the environment. In group B, social pressure seemed to be working both as a negative and positive impulse. Some stated that they were vegetarians or vegans in particular because of "climate anxiety"; others indicated that they were not willing to change their consumption behavior into more ecological behavior by changing their diets. As other important sustainability aspects, the participants mentioned the reduction of carbon footprint, locally produced food (or at least food that is not transported from the other side of the globe), food packaging that does not contain a considerable amount of plastics, genetically modified foods (GM foods), the impact of fish breeding and water footprint of the production. As the households in group B contained inhabitants with both meat and vegetarian diets, those with the latter usually had to justify their opinions. This also worked the other way around, as spouses or siblings encouraged the use of alternative proteins. In general, the young participants perceived that an individual can make a difference regarding the food waste and sustainability aspects by changing their consumption behaviors. They saw that this, however, depends heavily on personal motivation and how the individual receives and shares information. Moreover, the responsibility of the food industry was not overlooked; as a participant indicated: "I think the bigger changes should start where the food is produced, but I still think that also an individual can make a difference, e.g., with a choice of you buy from the grocery store."

3.2. Obstacles and Opportunities

The "Obstacles and Opportunities" for sustainable food consumption was formulated under the research question: "What are the incentives and barriers that would change Gen Z food consumption behavior into more sustainable one". The objective was to gain more in-depth understanding of Gen Z characteristics as future consumers relating to sustainable consumption behavior.

The biggest obstacles for minimizing food waste with group A were clearly associated with large food package sizes, planned or unplanned sizes of meal portions, lack of knowledge about the preparing of food, unplanned events, other social issues and the economic situation. The large size of food products was stated to be the main critical issue for this particular age group, in addition to the temptation of taking offers to buy

several items in order to have a discount. In the described everyday situations, it seemed to be difficult to estimate how much food is needed in practice: a person bought, prepared or measured out too much food and for some reason did not consume it all. Another problem was spontaneous events, which unexpectedly changed the consumption plans. As a participant elaborated; "I'm more willing to go for a dinner with my friends, than eat old casserole that was made several days ago". Other social obstacles were related to, for instance, a partner with an allergy or parents who brought too much food along with their visits. In group B the participants realized that many food waste habits are in fact based on the habits of their families. A participant clarified, "I really don't focus too much on food waste. Hardly any waste is generated, and it comes naturally. I suppose it has always been in the practices within my family." The experienced participants in group A spent a lot of effort on the minimizing aspects, but still a participant stated that, "Despite the awareness, sometimes laziness gets best out of the situation, or for some other reason food waste is not prioritized". Another participant contemplated the difficulty by saying, "Thinking of food waste on daily basis calls for creativity, when trying to come up with different kind of new dishes from the leftover food". The majority of the participants in group A were students, which clearly affected their economic choices. The participants described this by saying that often the price matters more than the environmental aspects. This group was also keen to buy food products labelled with a discount tag, close to the best before-date. The economical consumption decision was also described by saying that dairy products are typically considered cheaper than plant-based alternatives.

In the in-depth conversations with group B, the most commonly identified obstacle for sustainable behavior was the current, existing routines that were due to individual or social obstacles. Individual obstacles were commonly related to the reasons of not changing a diet, e.g., due to the poor taste or structure of alternative protein sources (e.g., vegan cheeses) or allergies (e.g., a diet consisting of beans or legumes, which caused gastric problems). The Gen Z participants were also worried about the nutritional intake of vegetarian food, by detailing that they had no skills to compose a diet in a healthy way. Social obstacles towards food waste reduction were mainly related to old-fashioned or biased family values, choices or preferences that the adolescents could not influence. The wider-scale social obstacles were seen to be created by "infrastructures that, in general, should encourage more sustainable lifestyles". In this, the participants explicated that they would eat more alternative protein source products if their prices were lower and they did not compromise their diet. For the manner to overcome these obstacles, the participants stated that more information, tutoring and education about the sustainability aspects of food waste was needed, in addition to adopting new routines and learning new skills.

Overall, the Gen Z participants in both groups A and B expressed a strong motivation to reduce food waste. As practical opportunities for changing their consumption behavior towards more ecological one, they mentioned: the steering of interest towards organic and local food products, purchasing of waste food meals from the restaurants or shifting their diets to vegetarian ones. Otherwise, the opportunities were considered mainly from the aspect of personal living situation. In group B, the adolescents who were living at home with families said that their parents mainly did the grocery shopping. They expected that moving out from their parents' household would create a new situation in which it would be easier to steer food consumption habits. This was verified by group A participants, of whom most were living alone. They perceived that living by themselves was the critical point in which they started to make choices about their personal food consumption behavior. A participant formulated this by saying, "It is easy to minimize food waste, because you are preparing food just for yourself." However, there is no freedom without responsibility, as another mentioned: "When one is living by oneself, the amount of food waste may even increase". In most cases this was because of the place of residence, which for the majority was close to the city center or densely populated communities in the urban area. When requesting to assess the pros and cons of their close environment, the participants responded inversely. Some saw it to be convenient to have a grocery nearby, because

"one could visit it on-demand and not store foodstuff at home". In conflicting comments, the nearby grocery stores were seen to encourage impulse buying and unnecessary food purchases. The central location also encouraged eating out in restaurants, which sometimes caused food waste, as the food stored at home was not consumed. One the pro side, living in the urban area made it possible to exploit mobile applications that reduced restaurant food waste. As a rational note, a participant commented how *not* living in the city center affected their personal relation to food and its appreciation: "When I plant my own potatoes, the appreciation of food grows higher, and nothing gets wasted". Another continued that if people would clearly see and feel the origin of food, it would affect their food waste practices positively. To sum the thoughts on the opportunities provided by the living situation, "In the countryside people tend to spend more time at home and visit grocery stores less frequently. Therefore, the shopping visits are more carefully planned. On the other hand, in the city households have more recycling possibilities and people with higher education. This means that they are more aware of the consequences of their choices on the environment".

As a reflection, the obstacles for changing Gen Z food consumption behavior more sustainable were related to:

- Large food package sizes, prizing/discount of food products
- Unplanned events
- Planned or unplanned sizes of meal portions
- Know-how: cooking skills, what to do with leftovers, trying out new recipes
- Existing routines when changing a diet
- Poor taste or structure of alternative protein sources
- Nutrient intake of a diet, allergies or gastric problems
- Social issues (e.g., gender or generation stereotypes, "old-fashioned" family values)
- The economic situation

The opportunities were related to:
Supporting the shift of a diet, by:

- Reducing inadvisable products (e.g., dairy and meat in vegan or vegetarian diets)
- Encouraging self-discipline
- Learning food preparation and cooking skills

Providing concrete information, tutoring and education, about:

- Effects of certain food products on the environment, carbon footprint
- Similar food products for effortless comparison
- Nutritional aspects
- Nutritional requirements and dietary recommendations

Encouraging sustainable food consumption, by promoting:

- Alternative protein sources (e.g., tofu, seitan, insects)
- Organic food (no chemicals, no GM foods or animal by-products)
- Products supporting animal welfare standards (e.g., free-range eggs)
- Promotion of local food, or domestically produced food
- Minimizing used plastics in food packaging

3.3. Habits and Future Consumer Motivations

The "Habits and Future Consumer Motivations" part of the framework was formulated under the research question: "What are the current habits and socio-technical aspects that would change Gen Z food consumption behavior into a more sustainable one". As regarding the COM-B model, the part focused on the motivational aspects i.e., the conditions in which a future consumer would change his or her consumption behavior [21]. The online questionnaire for group A was explicitly formulated for the follow-up technical development of a food waste application, Cook Clever, and to contribute the design insights for its Habit Library. The framework was founded roughly on the work of Stancu et al. who have explored the behavioral aspects of food waste through the utilization of the Theory of

Planned Behavior (TPB), and how food routines may factor to food waste levels [23]. The claims and responses concerning food consumption routines and habits are presented in Table 3.

Table 3. Claims and responses concerning the food consumption routines and habits.

The Claim	Min	Max	Avg.
I plan my meals and food purchases ahead	1	7	4.41
I often make impulse purchases	1	7	5.04
I frequently make a list of foods I want to buy prior to the shopping trip	1	7	4.86
I tend to buy too large package sizes	1	7	3.32
I usually buy higher amounts of food when they offer good value for money	2	7	4.82
I tend to make several smaller shopping trips	2	7	4.68
I usually do one main shopping trip (e.g., once per week)	2	7	4.81
I usually have leftovers from meals	1	7	4.72
Leftovers are usually eaten as such or just reheated when used again	3	7	6.09
Leftovers are usually transformed into a different dish by adding some ingredients before eating them	1	7	4.05
Leftovers are stored in appropriate conditions so they will last	1	7	4.41
Leftovers are often forgotten and spoil	1	7	3.00
I frequently check my food inventories and clean my food storing spaces	1	7	4.32 [1]

[1] Seven-point Likert-scale: Strongly disagree (1)–Strongly agree (7). N = 22.

As Table 2 shows, the particular problems of Gen Z food consumption habits were verified in relation to planning skills, impulse behavior, creativity with the leftovers and idleness. For support, the participants clearly expressed a need for a social food waste application where information about food waste would be easily available and obtainable. The participants expected the application to be user-friendly, highly visual, safe and free of charge. As a good motivator, the participants mentioned social features or a community that encourages economical consumption by exploiting sharing economy practices (as an example of this, they described locally produced, shared vegetable boxes they used to buy within the student housing community). The growing of a network—a small number of committed individuals, family or friends—was seen as a significant way to increase the population that "would make a difference". As motivational features for the application, the participants in both groups A and B mentioned:

- Providing seasonal or otherwise relevant food recipes
- Presenting food waste somehow as an ascending and positive trend
- Engaging celebrities and influencers to the community
- Information about diets and nutrition data
- Comparing information with meat and vegetarian diet
- Realistic information about the livestock production and its harm to the environment
- Providing informal data about the environmental effects of different food products
- Statistics about how much a certain food product approximately creates food waste
- The carbon footprint of wasted food (in addition with the normal carbon footprint)
- Financial savings made by food waste reduction
- Assistance in making sustainable and economic choices during grocery shopping
- Finding ecological alternatives while shopping
- Food products and items that are sold with discounted prices in close-by groceries
- Information about grocery store food waste
- Reminders of food storage content at home
- Products and items that are close to the best before- or use-by-date in one's personal storage
- Food recipes for items that are close to the best before- or use-by-date
- Information about growing and picking berries, mushrooms or herbs instead of buying them
- Information about allotment gardening, e.g., a garden full of apples, and the willingness to share the harvest with others

Concerning the last remark, a participant informed in more detail that: "If information about allotment gardening in the city district was targeted towards my age group, twenty-somethings, I might be interested to do that with friends. Sharing the yield would be enjoyable and certainly a factor that would minimize food waste." Another participant, clearly already an expert on the matter, clarified: "In my own food cooperative society, the thing what motivates me most is working together, and the feeling when I get to put my hands into dirt." The need for a community when getting familiar with allotment gardening, was articulated as, "It would be easy if someone first orientates herself to the topic and gives you the information and how to apply it into action."

Regarding the application development, the participants in group A were requested to state what kind of opportunities relating to knowledge receiving and social sharing would motivate them. They responded:

- Available information (e.g., about environmental sustainability) (9 responses)
- Social recommendations (e.g., from friends) (5 responses)
- Context-aware tips, hints and reminders (4 responses)
- Campaigns and competitions (e.g., sponsored by associations, trusts or companies) (2 responses)
- Self-/co-created context (e.g., tips, snapshots, recipes) (1 response)
- Rewarding (1 response)

As a final note, the young participants expected companies, organizations and the government to make the journey of all food products as visible as possible and provide clear information about the environmental effects caused by waste food.

3.4. Design Outcome of the Social Design Process

The design outcome of the social investigations was to embed the research findings—the elicited attitudes, routines and skills of the Generation Z consumers—to a technical Cook Clever application that supported sustainable food consumption behavior. It was anticipated that, in general, digital technologies have great potential to support the change at the individual level, especially when involving social technologies where choices are motivated by peers and community.

The main feature of the application was Habit library that was expected to steer the Gen Z consumers' patterns towards more sustainable performance by encouraging food waste reduction. The Habit library was based on known categories of food waste behaviors—planning, shopping, cooking, storing and eating—and the individual food consumption and food waste habits were assessed in relation to the targeted behavior (see Table 4).

The Cook Clever application made personalized suggestions of the potentially suitable habits and provided reminders on performing the actions. In addition, the application contained a social feed for sharing and discussing food waste solutions; it tracked performances in order to gain feedback and gave positive reinforcement and support for the targeted behavior. The iterative development of the Cook Clever application and its evaluations is described in detail elsewhere. The initial results, alongside the application development—as well as the results of this article—suggest that in future work, the most important features should focus on the social aspects, the role of sponsoring and the study of localization and context-awareness potential.

Table 4. Examples of the Cook Clever application suggested habits that were based on the research findings.

Eat the Veggies First!	Save the Rest for Later!	Hunt for Yellow Stickers!	Check Your Current Stocks!
			
Eating Fruit and vegetables have the highest wastage rates of any food type. When you are in a hurry, eat the soon-to-spoil veggies first.	**Cooking** If there are leftovers from your meal, let them cool, put them in a box and pop them in the fridge or freezer. You will have a handy meal for another day.	**Shopping** Check out the food products and items close to their best before or use-by dates, sold at discounted prices in close-by grocery stores.	**Storing** Found a good recipe, and ready to go shopping? First check what you already have in your freezer, fridge and cupboards and buy only what is missing. Make an inventory of the food supply [1]
Prioritize food consumption [1]	Meal planning [1]	Make durable choices [1]	

[1] Targeted Behavior.

Based on the initial findings, the social aspects of the Cook Clever application were seen to be important, in particular because the Gen Z consumers stressed that they were not willing to share any real personal information (i.e., by using their face and name). This was because food waste was generally seen as a negative concept, and at least the non-context experts preferred to use the application in private. The social sharing ecology included only close friends and family (most preferably the spouse). The social ecology was expected to be limited, because it was seen that expert or lead users might make the application more disruptive. With the close social community, the participants were motivated to create new habits, challenge each other, compete, share tasks and collect performances together. It was seen that by creating new habits together it would allow to multiply new ideas, as people had different approaches to solve the same problem.

In general, the Generation Z participants exhibited a positive attitude towards involving companies with the behavior change process, through sponsoring activities. They were interested in new waste food products, zero-waste competitions and monetary reward after demonstrating good performance (e.g., coupons or free delivery). In practice, the participants mentioned local companies, grocery stores and restaurants, NGOs and educational institutions; in particular, they were interested in what innovations they may have to solve the food waste problem in addition with information about the environmental aspects of their products. Sponsoring included the idea of involving influencers (preferably profiled in sustainability) and top chefs, e.g., by podcasts, blogposts, Instagram stories and YouTube videos.

Engagement with the local restaurants and grocery stores, which the participants specifically necessitated, would allow the developing of localization and context-aware features for the application. An example of a desired feature was illustrated as e.g., "If a person was in a particular restaurant, the application could provide tips if the meal sizes are too small/big and provide further guidance". The participants expected that these features could be implemented in most of the existing habits presented in the Cook Clever application. Localization at home was seen even more important, as being at home would activate such habits as e.g., "make inventory of the food supply". In this, the timing was vital, since the habits should be prompted at just the right moment, by considering what time of day most food waste is generated.

4. Discussion

In this social design research, it was important to discover how young, future consumers perceived sustainable food consumption and waste management. Generation Z was defined as the explicit target group, since young adulthood was verified as being

the critical time for establishing certain independent lifestyles and practices, as suggested e.g., by [8]. In the context of this research, a sustainability framework [26] was developed for investigating future consumers' food waste creation and consumption patterns on the verge of sustainable transition. The framework studied the Gen Z experience, obstacles and opportunities relating to behavior patterns, in addition with the current habits—with respect to planning, shopping, cooking, eating and storing [23]—and future motivations. The design framework provided a substantial contribution for the application development processes.

The participants in all groups seemed to believe in the possibilities for an individual to make a difference; in addition, they considered it to be relatively easy to avoid food waste. Especially the younger participants recognized that their attitudes towards food came from their families as part of the upbringing; results that are well in accordance with earlier studies, e.g., [8,9]. The participants articulated that this phase in their lives was an important one for creating personal and durable practices. However, the everyday life of this age group seemed rather spontaneous, which made it more difficult for them to manage food waste. Information on how to cope with it, and especially the transparency in knowledge-creation towards consumers was expected mostly from the food and retail companies. When making purchasing decisions, the price seemed to matter more than the environmental aspects, due to the economic situation. This was in accordance with previous studies, in which the high price was found to be the utmost barrier in making climate-friendly food choices [13]. Seriousness in the attitude towards sustainable food consumption and food waste seemed somewhat contradictory to the findings of Kamendiou et al. [10], although the finding of this study cannot be generalized due to the small and geographically limited population sample.

Regarding the design outcome, the behavior change application, the most important findings related to the social aspects: the role of company sponsoring, localization and context-aware potential and the need to engage wider sustainability aspects in the behavior change framework. Above all, the participants expected more information about the global benefits, carbon footprint, support for dietary shifts, comparison of diets and financial savings. In this, it was emphasized that there should be reliable sources sharing the fact-based information, and that the information should not be force-fed, but presented in a user-friendly and timely fashion. In the research for studying barriers to climate-friendly food choices among young adults in Finland, Mäkiniemi and Vainio (2014) pointed out that people are not necessarily aware of the factors affecting their food choices [13]. Based on their results, the main barrier with the highest inhibiting effect on food choices was the complexity of the climatic effects in relation to food consumption. This was in accordance with the findings of this study, i.e., that the easy availability of fact-based information, by reliable sources, was of utmost importance when promoting climate-friendlier consumption behavior.

Throughout the social design investigations, the future consumers raised important issues that should be taken into account in further research. As a final note, the Gen Z participants specified:

In group A: "I do feel bad about food waste. It is always unintentional . . . I would take any behavior change application to use, if it would help me to reduce waste. I feel strongly about the ecological responsibility!"

In group B: "Household food waste is a large-scale problem, since many individual life factors affect it. It is not just what one individual does, all the other people close by also influence it."

In the application development group C: "Most of the presented habits are something that I already do. Those that are missing . . . I suspect that a notification or reminder would not motivate me: I do remember those, even without an app. I just don't know why I do not take a better care of those . . . They just are not so clearly in my thoughts all the time." Furthermore: "I was surprised to find out that there were many habits suitable for me. I knew before that I was good at minimizing food waste, but I am willing to do even better."

5. Conclusions

This qualitative, pragmatic social design demonstrated two case studies and initial results of an application development that was formed around the concepts of future consumers and food waste. The social design aimed at finding solutions for the predefined Generation Z ecology in Finland. The study was based on qualitative research among young Finnish citizens, who were mainly from three major cities, and therefore not a representative sample of Gen Z in Finland. The social design research produced local understanding that described the nominated context, and, thus, the study cannot be applied uncritically to any other, or even a similar, case. In addition, this population group expressed a more positive attitude towards climate-friendly behavior, unquestionably due to their educational background. On the other hand, especially due to their interest towards sustainability aspects, the Focus Group participants were most suitable for co-creating the Cook Clever application that supported sustainable food consumption behavior. The contribution of the study can be seen as temporary rather than something long-standing, and the work continues by following the obtained knowledge. Indeed, based on the findings, there are a considerable number of socio-techno-economic features that the Gen Z consumers are expecting in the future. In practice, the work continues by developing several new features to the application that encourage the future generation in their attempt to face distressing climate change and global warming challenges. The results cast optimism that the social design studies and small-scale inventions may well respond to the global food waste challenge and lead to a more ecological and sustainable future.

Supplementary Materials: The following are available online at https://www.mdpi.com/2071-1050/13/4/2124/s1, the used questionnaire in the asynchronous and synchronous online Focus Groups and the Statement of the Ethical Committee of VTT.

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